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Ethno-veterinary medicinal uses of garlic (*Allium sativum*) by livestock rearers

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Garlic (*Allium sativum*) is used as an important ingredient in the traditional veterinary ethno-medicine since long time among the farmers. The knowledge of the use of garlic individually or additively with other ingredients is scattered in different regions as well as literature. The study was undertaken during 2018-19 to screen the ITKs available in the different sources in which the use of garlic is predominant in ethno-veterinary practices and validate these ITKs with the experts. The validation of ITK was done with 30 experts having the experience in veterinary and ITK practices for their relevance in scientific scenario. The responses of experts for validation were taken on 3-point validity continuum. Out of 46 formulations of garlic with other herbal additives, 56.52% were claimed to have the score above 120 out of 150, showing their wider applicability and validity in ethno-veterinary practice. Ethno-veterinary use of garlic was found for curing cough, cold, fever, urinary problems like oliguria & anuria, bloat, foot and mouth disease, pleuropneumonia, otalgia, dog bite, snake bite, trembling, respiratory system disorder like pleuritis and pneumonia, yoke gall, bone fracture, flatulence, wounds and gangrene. Due to allicin and other sulfur compounds, garlic has antibiotic, antibacterial and antimycotic properties. Ready availability of garlic in every household can be a cost effective first aid or emergency prescription to the livestock rearers who have no immediate access to modern veterinary facilities.

Keywords: Animal husbandry, Garlic, Indigenous technical knowledge, Validation

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Garlic (*Allium sativum*) plant possesses multipurpose medicinal values. Therefore, it is widely used in traditional system of medicine. Garlic contains various medicinal properties which are effectively used individually or additively in human as well as animal healthcare. Garlic is widely cultivated all over the world and unlike other wild medicinal plants it is readily available in all the households. Antibiotic, antibacterial and antimycotic properties of garlic due to allicin and other sulfur compounds have been testified by in vitro studies[1-3]. Garlic extracts have been used for centuries in traditional medicine, industrial applications, food preservatives due to their antimicrobial (oxygenated sulfur compound, thio-2-propene-1-sulfinic acid S-allyl ester, which is referred to as allicin) properties. It seems that the use of herbal extracts of garlic is a natural alternative for antibiotics in animal healthcare[4-6]. Garlic improves nutrient digestibility and possesses antimicrobial (oxygenated sulphur compound, thio-2-propene-1-sulfinic acid S-allyl ester, which is referred to as allicin), anti-inflammatory, anti-oxidant and immunostimulant activities.

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The indigenous knowledge of ethno-veterinary medicine and its implication has been recognized by the farmers through the process of experience over hundreds of years. Livestock rearers in rural areas still extensively depend upon folk wisdom practices of plants and household remedies for curing veterinary ailments. Most of the ethnoveterinary medicine are merely found in the distant rural and wild areas, however, garlic, being multipurpose medicine and readily available in every household, can be effectively used for prevention and curing the veterinary disorders. However, the available literature on the ethnoveterinary medicinal use of garlic is scattered. Therefore, the present investigation was undertaken to document and review the ethnoveterinary medicinal use of garlic and validate the documented practices with the experts in the specialized area for its scientific confirmation.

Methodology

The present study was carried out to validate the available scattered knowledge of garlic use in ethno-veterinary medicinal practices. The important ethnoveterinary uses of garlic in Indigenous Technical

Knowledge (ITK) for maintaining the health and curing diseases of animals among the livestock rearers were screened during 2018-19 from various published articles, research studies and thesis. The selected uses of garlic in ITKs were administered to the experts for confirming their scientific validity. Validity refers to the degree to which the data are realistic. The validation of ITK was done with 30 experts for their relevance in scientific scenario. The responses of experts were taken on 3-point validity continuum and the responses were scored 5, 3 and 1 for Scientifically Valid, Uncertain and Not Valid, respectively[7]. Thus, one ITK could get a maximum score of 150 and a minimum of 30. The rationale was provided for the use of garlic in the ethno-veterinary medicinal use.

Results and Discussion

The important ethno-veterinary practices with their validity score and rationale are presented in Table 1. Results showed a varied level of perception of experts on different ethnoveterinary practices. A total of 46 formulations of garlic with other herbal additives have been shown with the validity scores. Majority of the formulations (56.52 %) were claimed to have the score above 120 out of 150 which shows their wider applicability in ethnoveterinary practice and scientific validity of the uses of garlic in veterinary ailment. Whereas the ITKs claiming lower scores were also have wider followers in the field, hence cannot be neglected and these formulations need to be further tested in order to validate their efficiency.

Table 1 — Validity and rational of ethnoveterinary use of garlic by experts

Ethno-medicinal formulation	Researcher Name, year, place	Validity				Rationale
		SV	U	NV	VS	
Cough, cold and fever A paste made from ghee, black pepper (*Piper nigrum*), ginger (*Zingiber officinale*) and garlic (*Allium sativum*) divided into 2 parts and one part is fed to the animal and other part is topically applied over head and neck[8].	De *et al* (2004)[8] West Bengal	23	5	2	132	Garlic is a powerful antioxidant (alliin, allyl cysteine, allyl disulfide and allicin compounds) antimicrobial (oxygenated sulfur compound, thio-2-propene-1-sulfinic acid S-allyl ester, which is referred to as allicin), antiviral (sulfur containing compounds such as allicine, diallyl disulfide, diallyl trisufide) (sulfur containing compounds such as allicine, diallyl disulfide, diallyl trisufide) and antibiotic properties. (allicin and thiosulfonates found in garlic but other sulfur containing compounds, such as ajoene, also decrease bacterial growth) Active components-sulfoxides, γ–glutamylcysteines
Bark of shishum (*Dalbergia latifolia*) + scales of onion (*Allium cepa*) + owa (*Carum copticum* L.) + scales of garlic (*Allium sativum*)[9]	Nirban (2006)[9] Maharashtra	19	10	1	126	
About 5 g aniseed (*Pimpinella anisum*), one bulb of garlic (*Allium sativum*), one onion (*Allium cepa*), two tablespoon full salt are ground and mixed in mustard (*Brassica nigra*) oil and then it is fed to ailing animals twice a day i.e. in morning and evening[10].	Kumar (2003)[10] Bihar	16	12	2	118	
Grinded garlic (*Allium sativum*) and bamboo leaves (*Bambusa vulgaris*) are fed to cows[11].	Karthickeyan & Gajendran (2004)[11] Tamil Nadu	19	10	1	126	
Jeera (*Cuminum cyminum*) and Garlic (*Allium sativum*) are boiled in water and fed to animal[12]	Mahto (2012)[12] Jharkhand	19	10	1	126	
Warm mustard (*Brassica nigra*) oil is rubbed over the entire body of animal after adding garlic (*Allium sativum*) in it[13].	Das *et al.* (2003)[13] Uttar Pradesh	20	8	2	126	
The feeding hot soup of jeera (*Cuminum cyminum*) and garlic (*Allium sativum*)[14]	Kumar (2003)[14] Himachal Pradesh	18	10	2	122	
Ephemeral fever and impaction Paste of 50 g Negad (*Vitex Negundo Linn*.) tender leaves, with 5 g seed powder of kali miri (*Piper nigrum*) and 4-5 bulbs of garlic (*Allium sativum*) is given once in a day for three days[15]	Galav *et al.* (2013)[15] Rajasthan	16	12	2	118	Antiviral (sulfur containing compounds such as allicine, diallyl disulfide, diallyl trisufide) properties (sulfur containing compounds such as allicine, diallyl disulfide, diallyl trisufide)

(*Contd*.)

Table 1 — Validity and rational of ethnoveterinary use of garlic by experts (*Contd*.)

Ethno-medicinal formulation	Researcher Name, year, place	Validity				Rationale
		SV	U	NV	VS	
Bacterial infection The leaves of pepper (*Piper nigrum*) and garlic (*Allium sativum*) are crushed and the selvin juice is mixed with butter milk or goat's milk and it is administered to the infected animals[16].	Bavin, Reslin, & Radhakrishnan (2003)[16] Tamil Nadu	18	9	3	120	Antimicrobial (oxygenated sulfur compound, thio-2-propene-1-sulfinic acid S-allyl ester, which is referred to as allicin), antifungal (allicin, sulfur compounds), antibacterial (allicin and thiosulfonates found in garlic but other sulfur containing compounds, such as ajoene, also decrease bacterial growth)
Stomach problem & Indigestion Triphala i.e., harad (*Terminalia chebula*), beheda (*Terminalia bellirica*) and amla (*Emblica officinalis*) (50 g each) is ground and mixed properly. Another mixture of clove (*Syzygium aromaticum*), garlic (*Allium sativum*), ajwain (*Hyoscyamus niger*) and methi (*Medicago falcata*) 20 g each is prepared by grinding properly. The two mixtures are mixed and about 400 mL water is added to it. This preparation is then fed to animals having stomach problem twice a day[17].	Ram (2003)[17] Himachal Pradesh	23	5	2	132	Garlic has various properties including improve nutrient digestibility, antimicrobial (oxygenated sulfur compound, thio-2-propene-1-sulfinic acid S-allyl ester, which is referred to as allicin), anti-inflammatory, anti-oxidant (alliin, allyl cysteine, allyl disulfide and allicin compounds), Immunostimulant and antiparasitic (organosulfur compounds (e.g., allicin)
About 3-4 leaves of madar (*Calotropis gigantean)*, 40-50 g garlic (*Allium sativum*) and 40-50 g turmeric (*Curcuma longa*) are crushed and boiled in 1 L water. After cooling, this mixture is given to the suffering animals[18].	Singh (2003)[18] Uttar Pradesh	19	10	1	126	
Mixture of 200 g of ginger (*Zingiber officinale*) + 200 g of garlic (*Allium sativum*) paste are given to the suffering animal[19].	Sivanarayana *et al.* (2011)[19] Andhra Pradesh	20	8	2	126	
Garlic (*Allium sativum*) bulb juice is given orally[20].	Rani (2001)[20] Uttarakhand	20	8	2	126	
The paste of garlic (*Allium sativum*) and ginger (*Zingiber officinale*) rhizome in equal parts[21].	Mishra (2013)[21] Odisha	21	7	2	128	
Onion (*Allium cepa*) or garlic (*Allium sativum*) bulbs are mashed and the paste is fed[22].	Jain & Shrivastav (1999)[22] Madhya Pradesh	18	11	1	124	
Tympany Leaves of kadavi (*Taraxacum officinale Wigg*.) + leaves of dinda (*Leea indica*) + garlic (*Allium sativum*) + triphala (*Zanthoxylum alatum*)[9]	Nirban (2006)[9] Maharashtra	22	8	0	134	Antiparasite (disulfide (-S-S-) bonds with free thiol (-SH) groups)
Leaves of vaivarna (*Crataeva tapia*) + garlic (*Allium sativum*) + owa (*Carum copticum L.*) + 250 mL butter milk[9].	Nirban (2006)[9] Maharashtra	16	13	1	120	
Mixture of kneaded wheat flour, ajwain (*Trachyspermum ammi*), fenugreek (*Trigonella foenum-graecum* L.), jaggary, onion (*Allium cepa*), asafoetida (*Ferula asafoetida*), garlic (*Allium sativum*) and turmeric (*Curcuma longa*) were mixed together and fed to the animal[23].	Kanwar & Yadav (2005)[23] Himachal Pradesh	26	2	2	138	Antibiotic
Garlic (*Allium sativum*) bulbs are fed[9].	Nirban (2006)[9] Maharashtra	18	10	2	122	

(*Contd*.)

Table 1 — Validity and rational of ethnoveterinary use of garlic by experts (*Contd.*)

Ethno-medicinal formulation	Researcher Name, year, place	Validity				Rationale
		SV	U	NV	VS	
Six pieces of the bulb of garlic (*Allium sativum*), fruit covers (25 g) of coconut (*Cocus nucifera*), bark or roots (25 g) of bhimkol (*Musa paradisiaca*), 10 leaves of pan (*Piper betel*), 40 seeds of jabrang (*Xanthophyllum phesta*) and 125 g rhizome of ginger (*Zingiber officinalis*). All these ingredients area ground to powder. This powder is divided into 7 parts and given orally[24].	Talukdar (2004)[24] Gujarat	19	10	1	126	
Intestinal worms 20 g garlic (*Allium sativum*) is pounded well and mixed with 200 mL vinegar and administered orally on a full moon day or a day before. For another 4 h no feed or water is given. The practice of giving treatment during waxing phase of the moon is advised because the multiplication of worms in the gut of the animal is very fast during that time, therefore the treatment kills maximum worms on the full-moon day[25].	Jerom (2004)[25] Gujarat	14	14	2	114	Antiparasitic (organosulfur compounds (e.g., allicin)) and antimicrobial (oxygenated sulfur compound, thio-2-propene-1-sulfinic acid S-allyl ester, which is referred to as allicin) (allicin content) properties
Urinary problem like oliguria, anuria Paste of the leaves of makadi (*Atlantia racemosa*), triphala fruits (*Zanthoxylum alatum*) + seeds of kali miri (*Piper nigrum*) + garlic (*Allium sativum*) was drenched (All quantities were 50 g -100 g)[9].	Nirban (2006)[9] Maharashtra	15	13	2	116	Urinary problem like oliguria, anuria is cure with garlic because garlic has antimicrobial (oxygenated sulfur compound, thio-2-propene-1-sulfinic acid S-allyl ester, which is referred to as allicin) (allicin) and antibacterial(allicin and thiosulfonates found in garlic but other sulfur containing compounds, such as ajoene, also decrease bacterial growth) properties
Bloat A mixture is made with pat alu (*Solanum tuberosum*) (one type of potato), turmeric (*Curcuma longa*), bel (*Aegle marmelos*), gad (*Euonymus atropurpureus*) (one type of creeper), ghee, garlic (*Allium sativum*), bark of peepal (*Ficus religiosa*) tree and fed to the cattle[26].	Niwas *et al.* (2013)[26] Uttar Pradesh	19	10	1	126	Garlic has antimicrobial (oxygenated sulfur compound, thio-2-propene-1-sulfinic acid S-allyl ester, which is referred to as allicin), anti-inflammatory, anti-oxidant, immuno stimulant and antiparasitic (organosulfur compounds (e.g., allicin)) properties (sulfur containing compounds such as allicine, diallyl disulfide, diallyl trisufide)
A mixture of few cloves of garlic (*Allium sativum*), a pinch of asafoetida (*Ferula asafoetida*), two spoons of mustard (*Brassica nigra*) oil and 10 g of Navsagar (*Ammonium chloride*) is fed to the animal[27].	Tiwari *et al* (2003)[27] Uttar Pradesh	19	10	1	126	
Make paste of asafoetida, onion (*Allium cepa*), garlic (*Allium sativum*) and ajwain (*Trachyspermum ammi*) (50 g each), and given to the affected animals[28].	Singh (2004)[28] Uttar Pradesh	18	11	1	124	
Jaggery, garlic (*Allium sativum*) and ginger (*Zingiber officinale*) paste is given to animals[7].	Ponnusamy *et al.* (2009)[7] Tamil Nadu	19	10	1	126	

(*Contd.*)

Table 1 — Validity and rational of ethnoveterinary use of garlic by experts (*Contd*.)

Ethno-medicinal formulation	Researcher Name, year, place	Validity				Rationale
		SV	U	NV	VS	
Foot and mouth disease Whole plant of jungli angoor (*Cissus quadrangularis Linn*.) (200 g) is ground with 50 g bark of amkuda (*Wrightia tinctoria*), 50 g leaves of nirgudi (*Vitex negundo*), 50 g powdered of kali miri (*Piper nigrum*) and 50 g bulbs of garlic (*Allium sativum)*[1,5]	Galav *et al*. (2013)[15] Rajasthan	15	10	5	110	Garlic has antibacterial (allicin and thiosulfonates found in garlic but other sulfur containing compounds, such as ajoene, also decrease bacterial growth), antifungal, and antiproteolytic activity
Garlic (*Allium sativum*) pieces are fried in mustard (*Brassica nigra*) oil and after the oil cools, it is applied on the muzzle region and a few drops are put in the mouth. The hooves are regularly washed with treated neem (*Azadirachta indica*) water (neem leaves are boiled in water and strained)[29].	Lal (2004)[29] Gujarat	18	8	4	118	
Pleuropneumonia Garlic (*Allium sativum*) or onion (*Allium cepa*) bulblets are fed[22].	Jain & Shrivastav (1999)[22] Madhya Pradesh	14	14	2	114	Anti-inflammatory
Otalgia /Ear pain The oil cooked with manjistha (*Rubia cordifolia*), asafoetida (*Ferula asafoetida*) and saindhavalavan (Rock salt) or cured only with garlic (*Allium sativum*) should be applied.[30]	Nilkanth (2016)[30] Maharashtra	14	14	2	114	Garlic's health benefits include antiviral, antibacterial (allicin and thiosulfonates found in garlic but other sulfur containing compounds, such as ajoene, also decrease bacterial growth), and antifungal properties. It also has anti-inflammatory (S-Propargyl-cysteine; allicin; diallyl trisulfide) and pain-relieving properties
Dog bites Bark of nagalkuda (*Ervatamia alternifolia*) + bark of parijatak (*Nyctanthes arbor-tristis*) + leaves of dhotra (*Datura metel*) extract of these materials mixed with 1 bulb of garlic (*Allium sativum*) and salt was drenched. This medicine was given at an interval of 2 h[9].	Nirban (2006)[9] Maharashtra	12	13	5	104	Antibacterial (allicin and thiosulfonates found in garlic but other sulfur containing compounds, such as ajoene, also decrease bacterial growth), antifungal (allicin)
Roots of jhinjhardi (*Triumfetta rhomboidea*) + leaves of makadi (*Atalantia racemosa*) + 5-6 kali miri (*Piper nigrum*) + 2-4 garlic (*Allium sativum*) bulb lets +7-8 triphala (*Zanthoxylum alatum*). Extract of these materials was drenched for 2 days[9].	Nirban (2006)[9] Maharashtra	12	14	4	106	Antibacterial (allicin and thiosulfonates found in garlic but other sulfur containing compounds, such as ajoene, also decrease bacterial growth), antifungal (allicin, sulfur compounds)
Snake bite Mixed the leaves of garlic (*Allium sativum*) and neem (*Azadirachta indica*) and juice is allowed to drink with water[31].	Phondani *et al*. (2010)[31] Uttarakhand	8	19	3	100	Antibacterial (allicin and thiosulfonates found in garlic but other sulfur containing compounds, such as ajoene, also decrease bacterial growth), antifungal
Trembling/ Shivering Bark of mango (*Mangifera indica*) + bark of kaju (*Anacardium occidentale*) + kali miri (50-100 g) (*Piper nigrum*) + 7-8 Garlic bulblets (*Allium sativum*) + khaskhas (*Papaver somniferum*) (25 g) extract was drenched [9].	Nirban (2006)[9] Maharashtra	17	11	2	120	

(*Contd*.)

Table 1 — Validity and rational of ethnoveterinary use of garlic by experts (*Contd.*)

Ethno-medicinal formulation	Researcher Name, year, place	Validity				Rationale
		SV	U	NV	VS	
Respiratory system- pleuritis and pneumonia Ginger (*Zingiber officinale*) + sunth (*Zingiber officinale*) (dried ginger powder) + white onion (*Allium cepa*) + khaskhas (*Papaver somniferum*) + seeds of kali miri (*Piper nigrum*) + garlic (*Allium sativum*) + leaves of Menaki (*Gymnema sylvestris*) + leaves of narayanmakadi (*Paramigniya monophylla*) + leaves of bendurli (*Dendrophthoe falcata*). Extract of above ingredients (50-100 g each) was drenched twice or thrice /day for 4-5 days[9].	Nirban (2006)[9] Maharashtra	18	10	2	122	Antimicrobial (oxygenated sulfur compound, thio-2-propene-1-sulfinic acid S-allyl ester, which is referred to as allicin) (allicin compound)
Turmeric (*Curcuma longa*) + white onion (*Allium cepa*) + owa (*Carum copticum*) + bulb of garlic (*Allium sativum*). The extract of all the ingredients (20-25 g each) was drenched daily twice-thrice for two days[9].	Nirban (2006)[9] Maharashtra		21	7	2	128	
Respiratory disorders Tablets prepared by mixing young garlic (*Allium sativum*), sunth (*Zingiber officinale)*, omum (*Trachyspermum ammi*), salt and jaggery[13].	Das *et al.* (2003)[13] Uttar Pradesh	20	9	1	128	Antimicrobial (oxygenated sulfur compound, thio-2-propene-1-sulfinic acid S-allyl ester, which is referred to as allicin) (allicin compound)
Yoke gall of bullocks A paste from bulbs of garlic (*Allium sativum*), seeds of amaranth (*Amaranthus paniculatus* L.) and fruits of long pepper/pimpli (*Piper longum*) are prepared. The prepared paste is applied externally on the affected region[32].	Shantamma (2004)[32] Gujarat	19	10	1	126	Antibiotics and antibacterial (allicin and thiosulfonates found in garlic but other sulfur containing compounds, such as ajoene, also decrease bacterial growth)
Galghotu (*Hemorrhagic septicemia*) A lotion is prepared by mixing 500 g arna leaves (*Clerodandrum*), turmeric (*Curcuma longa*), garlic (*Allium sativum*) and salt (each 100 g). This lotion is rubbed on the swollen tongue[33].	Soormal (2004)[33] Rajsthan	14	14	2	114	Antibacterial (allicin and thiosulfonates found in garlic but other sulfur containing compounds, such as ajoene, also decrease bacterial growth) and antiviral (sulfur containing compounds such as allicine, diallyl disulfide, diallyl trisufide)
Bone fracture In this practice, paste of bark of pojo tree (*Litsea monopetala* (*Roxb.*) *pers.*), chandrasur (*Lepidium sativum*), brown salt, onion (*Allium cepa*), garlic (*Allium sativum*) and hadjod (*Cissus quadrangularis*) leaves are applied on and around the broken bone[34].	Jha (2003)[34] Jharkhand	13	14	3	110	Antineoplastic and antimicrobial (oxygenated sulfur compound, thio-2-propene-1-sulfinic acid S-allyl ester, which is referred to as allicin), antioxidant (alliin, allyl cysteine, allyl disulfide and allicin compounds) properties
Flatulence Prepare a mixture of madar (*Calotropis gigantean*) and amaltas fruits (*Cassia fistula Linn.*) with garlic (*Allium sativum*), ajwain (*Trachyspermum ammi*), black pepper (*Piper nigrum*) and mustard (*Brassica nigra*) oil and give this mixture to the suffering animal[35].	Singh (2003)[35] Uttar Pradesh	21	6	3	126	Antiviral (sulfur containing compounds such as allicine, diallyl disulfide, diallyl trisulfide) and antibacterial (allicin and thiosulfonates found in garlic but other sulfur containing compounds, such as ajoene, also decrease bacterial growth)

(*Contd.*)

Table 1 — Validity and rational of ethnoveterinary use of garlic by experts (*Contd*.)

Ethno-medicinal formulation	Researcher Name, year, place	Validity				Rationale
		SV	U	NV	VS	
Cleaning of wound Garlic (*Allium sativum*) juice mixed with 3 or 4 part of water[21].	Mishra (2013)[21] Orissa	17	9	4	116	Antibacterial (allicin and thiosulfonates found in garlic but other sulfur containing compounds, such as ajoene, also decrease bacterial growth), antimicrobial (oxygenated sulfur compound, thio-2-propene-1-sulfinic acid S-allyl ester, which is referred to as allicin) antifungal (compound allicin), antiviral (sulfur containing compounds such as allicine, diallyl disulfide, diallyl trisufide) (allicin, sulfur compounds)
Langari disease jerk their legs and feed deficiency to walk properly A mixture is prepared by frying 100-150 g of garlic (*Allium sativum*) in 40-50 mL oil and mixed with 10-15 g vermilion and applied on affected part.[36]	Singh (2003)[36] Uttar Pradesh	12	16	2	110	
Skin disorder Application of paste of garlic (*Allium sativum*)[13]	Das *et al*. (2003)[13] Uttar Pradesh	17	11	2	120	Antibacterial (allicin and thiosulfonates found in garlic but other sulfur containing compounds, such as ajoene, also decrease bacterial growth), antimicrobial (oxygenated sulfur compound, thio-2-propene-1-sulfinic acid S-allyl ester, which is referred to as allicin), Antifungal (compound allicin)
Gangrene Application of paste of garlic (*Allium sativum*)[13].	Das *et al*. (2003)[13] Uttar Pradesh	12	14	4	106	Antibacterial (allicin and thiosulfonates found in garlic but other sulphur containing compounds, such as ajoene, also decrease bacterial growth) properties
Colic Feeding mixture of ground omum (*Trachyspermum ammi*), black salt, black pepper (*Piper nigrum*), mint (*Mentha piperita*), fenugreek (*Trigonella foenum-graecum*) and garlic (*Allium sativum*)[13].	Das *et al.* (2003)[13] Uttar Pradesh	19	9	2	124	Antifungal (compound allicin), antibacterial (allicin and thio-sulfonates found in garlic but other sulphur containing compounds, such as ajoene, also decrease bacterial growth)

Note: SV- Scientifically Valid, U- Uncertain, NV-Not valid, VS-Validity Score

The results showed the wider applicability of the garlic along with the other ingredients on wider range of the veterinary ailments due to its medicinal values. In the veterinary ailment, for cough, cold and fever the anti-viral properties of garlic are effective due to sulphur-containing compounds such as allicin, diallyl disulfide, diallyl trisulfide that react with thiol groups of various enzymes which are critical for microorganisms[37,38]. Garlic plays important role to improve nutrient digestibility. Oxygenated sulphur compound, thio-2-propene-1-sulfinic acid and S-allyl ester available in the garlic improve antimicrobial, anti-inflammatory, anti-oxidant, immunostimulant and antiparasitic (organosulfur compounds - allicin)[39,40] properties which helps to cure the animals affected by bacterial infection, stomach pain and indigestion, tympany and intestinal worms. Due to these properties of the garlic, it has been used in traditional veterinary medicine to cure various ailments such as urinary problems like oliguria &

anuria, bloat, foot and mouth disease, pleuropneumonia, otalgia, dog bite, snake bite, trembling, respiratory system disorder like pleuritis and pneumonia, yoke gall, bone fracture, flatulence, wounds and gangrene.

Garlic in ethno-medicine has been used in combination with different other ingredient having the curative properties for various animal diseases or disorders. Though the readymade modern medicines are available in the market for many diseases, in remote rural areas, its timely availability is still a major constraint for farmers. Now a days, many plants or herbs used in ITK are not easily accessible as most of the plants are not in regular cultivation and rarely exist in local area. However, garlic being readily available in every household can be a cost effective first aid or emergency prescription to the livestock rearers who have no immediate access to modern veterinary facilities.

The use of garlic in veterinary ethno-medicine in combination with other ingredients, which have a high level of validity scores, should be popularized among the livestock rearers by the extension agents to reduce the expenditure on veterinary treatments. Efforts should be made to popularize the ethno-medicinal use of garlic in terms of preventive and curative properties. In many situations, lack of knowledge about preparation of garlic-based medicine in combination with other herbs in suitable dosage, hinders the wider use of garlic for curing the veterinary ailments. The kind of validity through standardization of use of garlic with other additives against different animal diseases and disorders through experimental approach would help in developing a new herbal mixture of drugs for the effective treatment. The experimental approach should be farmers participatory. Local ITK practitioners should be honoured and recognised[41]. The proven ITKs must be popularised in regional languages through print as well as ICT based social media for wider publicity and use. Collaborative efforts are needed by related institutions and NGOs with traditional healers who have knowledge of local resources for effective utilisation and popularisation of ITKs.

Conclusion

Garlic is readily available in all the households but knowledge of its use in ethnoveterinary medicine is restricted in few traditional communities. This locally available knowledge after validation is useful in the rural areas for preventive and curative treatment of animals in a cost-effective manner. Garlic having the multipurpose medicinal values can act as first aid for animal health in the scenario of high cost, side effects, drugs resistance and untimely availability of modern drugs. There is need to popularise the validated medicinal use of garlic in veterinary ailment.

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Conflict of Interests

Authors declare no conflict of interest.

Author Contributions

RBK & SSG: Conceptualization, design, drafting; RBK & AOP: Survey and analysis; KJ, VM & MS: drafting, review & editing

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